WHAT IS CLAIMED IS:

Sub A7 1. A charging system for a mobile robot comprising the mobile robot that is battery-driven and moves in a self-controlled way within a work space, and a charging station for accommodating the mobile robot for a battery charging operation, the charging system comprising:

visible recognition data arranged in a predetermined location of the charging station;

image pickup means mounted on the mobile robot;

calculating means for calculating a range and a bearing from the mobile robot to the charging station, based on an image picked up by the image pickup means; and

searching means for causing the mobile robot to search for the charging station, based on the calculation result provided by the calculating means.

2. A charging system according to claim 1, further comprising communication means for performing data exchange between the mobile robot and the charging station.

3. A charging system according to claim 1, wherein the visible recognition data is a print medium glued onto the surface of the charging station.

4. A charging system according to claim 1, wherein the visible recognition data is formed on a print medium, and a plurality of print media is glued onto the surface of a three-dimensional object, such as a cylinder, a quadratic prism, or a sphere.

5. A charging system according to claim 1, wherein the visible recognition data is displayed on a screen of a display unit.

6. A charging system according to claim 1, wherein the visible recognition data is displayed on a screen of a display unit, and is dynamically used in a manner that prevents the visible recognition data from being merged into the environment of the work space.

7. A charging system according to claim 1, wherein the visible recognition data is displayed on a screen of a display unit and is changed in response to a range from the mobile robot.

8. A charging system according to claim 1, wherein the visible recognition data is a combination of colors and patterns.

9. A charging system according to claim 1, wherein the visible recognition data is a two-dimensional bar code.

10. A charging system according to claim 1, wherein the visible recognition data is arranged on an elevated portion of the charging station.

Sub A3 11. A charging system according to claim 1, wherein at least one of the charging station and the mobile robot comprises an indicator indicating the condition of a battery, such as "Now charging", "Charging complete (with a battery fully charged)", or "Abnormal charging".

12. A charging system according to claim 1, wherein the charging station further comprises transmitter means that transmits at least one of light ray, infrared ray, sound wave, ultrasonic wave, radio wave, and magnetic field,

the mobile robot comprises receiver means for receiving the wave transmitted from the transmitter means, and

wherein the calculating means calculates the range and the bearing from the mobile robot to the charging station, based on at least one of the image provided by the image pickup means and data received by the receiver means.

Sub A4 13. A charging system according to claim 1, wherein the wave transmitted by the transmitter means is easily discriminated and separated from other signals created within the work space.

14. A charging system according to claim 1, wherein the mobile robot comprises a head unit which performs a scanning motion with respect to a torso unit, and

at least one of the image pickup means and the receiver means is arranged on the head unit.

15. A charging system according to claim 1, wherein the transmitter means transmits at least two signal waves, from among light ray, infrared ray, sound wave, ultrasonic wave, radio wave, and magnetic field, and the receiver means switches the received signal in response to the range between the charging station and the mobile robot.

16. A charging system according to claim 1, wherein the transmitter means projects light ray through a slit, and changes the pattern of the slit depending on the direction of light projection.

17. A charging system according to claim 1, wherein the transmitter means transmits at least two signal waves that are different in output intensity and frequency component.

18. A charging system according to claim 1, wherein the charging station comprises communication means for exchanging

data with a device other than the devices of the charging system.

19. A charging system according to claim 1, wherein the transmitter means is arranged external to the charging station.

20. A charging system according to claim 1, wherein the mobile robot is of the four-footed type which quadrupedally walks like a dog, and comprises a power connector on the abdomen of the torso unit thereof,

the charging station comprises a concaved receptacle, and a power connector arranged on the inner bottom portion of the receptacle, and

the receptacle supports the mobile robot in the lying down position thereof.

21. A charging system according to claim 1, wherein the charging station comprises, on the wall thereof, color patterns painted in at least two colors, and

the mobile robot searches for the charging station, based on the positional relationship of the color patterns in an image provided by the image pickup means.

22. A charging system according to claim 1, wherein the mobile robot is of the four-footed type which quadrupedally walks like a dog, and comprises a power connector on the hip portion

of the torso unit thereof,

the charging station comprises a receptacle with a bowl-shaped concave, and a generally semi-spherical projection on the generally central position of the bowl-shaped concave, and

the receptacle supports the mobile robot in the sitting position thereof.

23. A charging system according to claim 1, wherein the mobile robot is of the four-footed type which quadrupedally walks like a dog, and comprises a power connector on the hip portion of the torso unit thereof,

the charging station comprises a receptacle with a bowl-shaped, rotationally symmetric concave, and a generally semi-spherical, rotationally symmetric projection on the generally central position of the bowl-shaped concave, and

the receptacle supports the mobile robot in the sitting position thereof at any angle.

24. A charging system according to claim 1, wherein the mobile robot has a tapered portion on at least one of a head unit, and shoulders and hip portions of a torso unit, and

the charging station comprises a generally U-shaped structure having an inner wall which receives the tapered portion formed on the mobile robot.

25. A charging system according to claim 1, wherein the mobile robot has a tapered portion on at least one of a head unit, and shoulders and hip portions of a torso unit, and

the charging station comprises a generally U-shaped structure having an inner wall which receives the tapered portion formed on the mobile robot, and on the deepest inside position of the U-shaped structure, a lip having a connector arranged on the top surface thereof.

26. A charging system according to claim 1, wherein the mobile robot has a tapered portion on at least one of a head unit, and shoulders and hip portions of a torso unit, and

the charging station comprises a generally U-shaped structure having an inner wall which receives the tapered portion formed on the mobile robot, and on the deepest inside position of the U-shaped structure, a lip having a connector arranged on the top surface thereof, and each terminal of the connector extends inwardly deeply into the U-shaped structure.

27. A charging system according to claim 1, wherein the mobile robot is ambulatory, and an electrode terminal is arranged on the sole of at least one foot.

28. A charging system according to claim 1, further

comprising at least one electromagnet for generating a magnetic field that connects and disconnects the connector of the mobile robot to and from the connector of the charging station.

29. A charging system according to claim 1, wherein the charging station comprises a drive mechanism for placing the mobile robot in an appropriate engagement position therewith.

30. A charging system according to claim 1, wherein the charging station comprises a generally U-shaped structure that receives the mobile robot, and grip means for gripping the mobile robot within the U-shaped structure.

31. A charging system according to claim 1, wherein the charging station comprises a generally U-shaped structure that receives the mobile robot, and grip means for gripping the mobile robot within the U-shaped structure, and wherein the charging station is used as a carrying case with the mobile robot gripped therewithin.

32. A charging system according to claim 1, wherein the mobile robot is of the type that quadrupedally walks like a dog, and the charging station has a kennel-like configuration, and at least one connector is arranged on the inner wall of the charging station.

Sub A2 33. A method for searching for a charging station, based on a signal wave transmitted by a transmitter arranged external to the charging station in a charging system comprising a mobile robot that is battery-driven and moves in a self-controlled way within a work space, and the charging station for accommodating the mobile robot for a battery charging operation, the method comprising the steps of:

teaching the position of the charging station based on the signal wave from the transmitter after the mobile robot has been once placed on the charging station, and

searching for the charging station by calculating the range and bearing to the charging station, based on the signal wave from the transmitter, with the mobile robot at any position within the work space.

34. A method for searching for a charging station, based on a signal wave transmitted by a transmitter arranged external to the charging station in a charging system comprising a mobile robot that is battery-driven and moves in a self-controlled way within a work space, and the charging station for accommodating the mobile robot for a battery charging operation, the method comprising the steps of:

storing beforehand, in a memory of the mobile robot, the position information of the charging station with respect to a

reference position set in accordance with the position of the transmitter, and

searching for the charging station by calculating the position of the mobile robot with respect to the reference position, based on the signal wave from the transmitter with the mobile robot at any position within the work space, and reading the position information from the memory to calculate the range and the bearing to the charging station.

35. A method for searching for a charging station, based on a signal wave transmitted by a transmitter arranged external to the charging station in a charging system comprising a mobile robot that is battery-driven and moves in a self-controlled way within a work space, and the charging station for accommodating the mobile robot for a battery charging operation, the method comprising:

the calculating step in which the mobile robot calculates the position thereof with respect to the reference position set in accordance with the position of the transmitter, based on the signal wave from the transmitter,

the calculating step in which the charging station calculates the position of thereof with respect to the reference position, based on the signal wave from the transmitter,

the communication step in which the charging station communicates the position information thereof to the mobile

robot, and

the searching step in which the mobile robot searches for the charging station by calculating the range and bearing to the charging station through relative relationship between the positional information.

36. A mobile robot being ambulatory and having at least a torso unit and at least two foot units, comprising an electrode terminal for power feeding, at the end of at least one of the two foot units.

37. A mobile robot being ambulatory and having at least a torso unit and at least two foot units, comprising an electrode terminal for power feeding, on one of the abdomen of the torso unit and the back of the torso unit.

38. A mobile robot being ambulatory and having at least a torso unit and at least two foot units, comprising an electrode terminal for power feeding, at the end of the tail.

39. A connector having a generally semi-spherical projection, cut into at least a tip thereof and one frustohemispherical slice, each serving as a connection terminal.

40. A connector according to claim 39, wherein the tip of the generally semi-spherical projection terminal serves as a signal line, and the frustohemispherical terminal serves as a power line.

41. An electrical connection structure performing electrical connection with connectors mutually in contact, wherein one connector is probe-like, and the other connector is mesh-like, and wherein the electrical connection is established with the probe-like connector is inserted into the mesh-like connector at any position.

42. An electrical connection structure according to claim 41, wherein the probe-like connector has a plurality of terminals arranged along the longitudinal direction thereof, and the mesh-like connector has a plurality of layers.

43. An electrical connection structure performing electrical connection with connectors mutually in contact, wherein the electrical connection structure comprises at least one electromagnet which connects and disconnects one connector to and from the other connector.